

article having a porous structure and which can be part of a mold or form the mold itself.

It has been a third object of the present invention to provide a method for making the shaped porous article which may find utility in, for instance, a device for conducting a fluid between a space and a duct, such as in a mold which is used as a mold for deep-drawing.

It has been a fourth and particular object of the present invention to provide a shaped article made from the composition according of the invention which has a fine and finest and, in a preferred embodiment, a micro-structured surface which shaped article can be used as a mold for deep-drawing of plastic films, foils etc. into the surface of which the structures of the mold are transferred. The solution to this object allows for the imaging of fine and finest structures (micro-structures) on deep-drawn or engraved articles at small tolerances, resulting in an exact transfer of the topographies and micro-topography from the mold surface to the molded and/or deep-drawn article.

Detailed Description of the Invention

The present invention provides:

A composition comprising

- (i) a minor amount of a binder and
- (ii) a major amount of spherical inorganic particles (matrix particles).

According to the present invention the binders are selected from the group consisting of organic polymers and alkali silicates. The organic polymer binders are selected from the group consisting of thermoplastic polymers and cured polymers. In particular the binders are:

- (a) particulate thermoplastic polymers which are mixed with the matrix particles and which are subsequently sintered at a temperature above the melting point of the binder polymer,

- (b) liquid polymer resins which are mixed with the matrix particles and which are subsequently cured by thermal or chemical curing, and
- (c) aqueous solutions of sodium and/or potassium water-glasses which are mixed with the matrix particles and which are subsequently hardened by evaporation of water.

Polyetherether ketones (PEEK) are the preferred thermoplastic polymer (a). PEEK polymers having a heat distortion temperature of above 100°C, more preferably of at least about 150°C, and most preferably of at least about 175°C are well known in the art. In general PEEK polymers possess an excellent solvent resistance and an outstanding thermal stability (PEEK-melts are stable for more than one hour at 400 °C). It may either be a homopolymer comprising repeating units or a copolymer comprising various repeating units. The phenylene groups of the said repeating units may contain lower alkyl groups, halogen groups, nitro groups, nitrile groups, amino groups, phenoxy groups, phenyl groups and/or biphenyl groups.

The PEEK used in the present invention may be obtained by known state of the art polymerization methods. As an example there may be mentioned a method of condensation polymerising an aromatic dihalogen compound and a diphenol in the presence of an alkali salt. The said polymerization method is described in JP-B-57-22938, U.S. Pat. Nos. 4,113,699 and 4,320,224 and JP-A-54-90296. The disclosure of these references is incorporated herein by reference. The polymerization degree of PEEK used in the present invention is not particularly limited. The polymerization degree of PEEK is expressed as reduced viscosity obtained from measurements at 25 °C with an Ostwald viscometer of a 0.1 percent PEEK solution (PEEK weight/concentrated sulfuric acid volume), the solvent being concentrated sulfuric acid having a density of 1.83g/cm³. The measurement should be performed in the vicinity of 25 °C immediately after PEEK is dissolved in order to minimize the influence of sulfonation. The viscometer of an approximately two minute solvent efflux time is used in the measurement. The reduced viscosity of PEEK used in the present invention is ordinarily in the range of 0.5 to 2.5 dl/g. In order to

obtain high mechanical strength of the resulting membrane, it is preferred that the reduced viscosity is in the range of 0.8 to 2.5 dl/g.

In an alternative the thermoplastic polymers (a) can be selected from the group consisting of polyvinylchloride (PVC), polypropylene (PP), polyethylene (PE), acrylnitrile-butadiene-styrene-copolymers (ABS), polycarbonates (PC), polymethylmethacrylate (PMMA) and polyvinylidenfluoride (PVDF), and thermoplastic polyolefins (TPO). Preferably these thermoplastic polymers have a heat distortion temperature as defined above.

Epoxy resins are preferred as the liquid curable synthetic resin (b). Epoxy resins are prepolymers that contain on the average two or more epoxide groups per molecule. Their reaction with a variety of curing agents leads to cross-linked or thermoset plastics with excellent strength, toughness and chemical resistance. Suitable epoxy resins are known from the prior art and commercially available. For instance, D.E.R.[®], D.E.N.[®], Tactix[®], Quartex[®] supplied by Dow Chemical; Epon[®], Epikote[®], Eponol[®], Eponex[®] supplied by Shell; Araldite[®], Aracast[®] supplied by Ciba Geigy; Epi-Rz[®] supplied by Celanese, Epotuf[®] supplied by Reichold or Unox[®] supplied by Union Carbide, Neukadur[®], Biresin[®] and Ebalta LM[®] can be used.

Important multifunctional curing agents for said epoxy resins include aliphatic and aromatic polyamines, dicarboxylic acid anhydrides, polyamide amines, aminoplasts and phenoplasts.

Further suitable liquid curable synthetic resin (b) in accordance with the present invention are polyurethane (PU) resins, alkyd resins, unsaturated polyester (UP) resins, melamine resins, polyacrylate resins, vinylester resins and phenolic resins which are obtainable from condensation reactions of phenols with aldehydes or ketones.

The aqueous alkali silicate binder (c) is selected from the group consisting of sodium-water glasses, potassium water-glasses and mixtures thereof. This binder (c), once hardened, is known for its superior thermal resistance

After mixing an aqueous solution of water glass and the matrix material the resulting premix is subsequently hardened by the evaporation of water.